

*CAREX CASTANEA* × *C. DEBILIS*, A NEW  
NATURAL HYBRID FROM ONTARIO

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ABSTRACT

A high level of achene sterility, non-exserted anthers, and intermediacy in qualitative and quantitative characters support the recognition of plants from the shore of Wendigo Lake in northern Ontario as *Carex castanea* × *C. debilis*, a new natural hybrid. This new taxon has prominent leaf pubescence like *C. castanea*, but relatively narrow leaves (less than 2.5 mm wide as in narrow-leaved specimens of *C. debilis*). The floral density of the spike and many other characters are more or less intermediate. This hybrid is probably scarce because of the evident edaphic isolation of its parents. A key and description are included.

Key Words: *Carex* section *Sylvaticae*, *Carex castanea*, *Carex debilis*, hybrid, Ontario, Canada, North America

INTRODUCTION

*Carex* × *knieskernii* Dewey, the hybrid of *C. arctata* Boott and *C. castanea* Wahl., both species in section *Sylvaticae*, is a widespread taxon and one of the better known hybrids in the genus *Carex* in North America (Cayouette and Catling, 1992), but few other hybrids involving *C. castanea* have been reported. Since *C. castanea* is conspicuously pubescent, unlike most North American species of *Carex*, and this character may be expected in its natural hybrids, the hybrids involving *Carex castanea* should be easy to recognize.

Several plants of *Carex* found along the upper, semi-wooded shore of Lower Wendigo Lake in Larder River Provincial Park, northern Ontario had leaves 1.5-2.5 mm wide and were clearly not referable to *C. castanea*, the wider leaves of which are 4.5-8 mm wide, yet they had distinctly pubescent leaves and sheaths, ovate perigynia and drooping pistillate spikes, thus suggesting a hybrid origin involving *C. castanea*. The non-exserted, poorly developed anthers and development of only four achenes from 700 pistillate flowers also suggested a hybrid origin. The purpose of the work reported here was to assess the likelihood of a hybrid origin and to provide evidence for the parentage.

## METHODS

Fifteen morphological characters (Table 1) were selected and measured in 10 specimens of each of *Carex arctata*, *C. castanea* and *C. debilis* from throughout Ontario. The same 15 characters were measured in 4 specimens of *C. × knieskernii* from four widely separated localities in eastern North America and in four specimens of the putative *C. castanea × debilis* hybrid from Wendigo Lake. The length of the longest hair on a lower leaf was measured along the lower edge of the leaf. The total culm height was measured from the roots to the tip of the staminate spike. The length of the lowest peduncle was measured from the culm to the base of the spike. The lowest pistillate spike length was measured from the base of the lowest scale to the tip of the longest perigynium. Although the achenes of the putative hybrids *C. castanea × debilis* and *C. × knieskernii* were mostly aborted, they were still partially developed and stalks could be measured.

Material measured included: for **Carex arctata**, Calder 788, 7111, Cody 6464, Dickson & Martin 1656, Dore & Koyama 19938, Laird 25 May 1952, Soper & Lindsay 9659, Varga 5 May 1982, Wood 29 May 1934, Zgierska 27 May 1985; for **Carex castanea**, Brunton 6022, Calder 3106, 3132, Garton 2073, 7329, 11887, Jennings 14241, Lepage 38019, Lloyd 20 June 1946, Mayall & Cormack 151; for **Carex castanea × debilis**, Catling & Catling 91-224; for **Carex debilis**, Barkworth 2041, Calder 1952, 1969, 6505, Garton 4836, Gillet & Dore 7636, Hart 1490, Jenkins 4708, Moore 2609 and Watson 3859; for **Carex × knieskernii**, Calder 3107, Johnson 28 June 1981, Lepage 36308, Williams, Collins & Fernald 18 July 1902. Means and standard deviations of the characters for the different groups were compared. Additional material of all groups was examined to ensure that the samples were representative, although not necessarily fully comprehensive with respect to the variation within taxa. The key and description are based on a larger sample than that providing the basis for Table 1.

## RESULTS AND DISCUSSION

Although the sample sizes employed are small, they do cover a broad area and examination of many additional specimens suggested that the data in Table 1 were indeed representative of the 5 taxa, especially in the northern Ontario portions of their ranges.

While both *C. arctata* and *C. debilis* Michaux have inconspicuously scabrous-pubescent sheaths and *C. debilis* also often has scabrous-pubescent leaves, the pubescence of the putative hybrid was much more prominent, being 0.5–0.6 mm long on the lower leaf surface (Table 1). Of the *Carex* species occurring in the local area where the putative hybrids were found, only *C. castanea*, with longer pubescence on the lower leaf surface 0.5–0.7 mm long is comparable, and consequently *C. castanea* is almost certainly one of the parents. Among the species in the neighbourhood that possessed some characteristics of the putative hybrids were *Carex arctata*, *C. capillaris* L. and *C. debilis*. Considering ways in which the putative hybrids differed from *C. castanea*, the other parent would have to have relatively narrow leaves, relatively long pseudoculms, relatively long spikes, more rounded scales, relatively narrow perigynia, and relatively long-stalked achenes. The only species that satisfies all of these criteria is *Carex debilis*. *Carex arctata* has leaves too broad and acuminate scales (Table 1), whereas *C. capillaris* has spikes that are too short (< 2 cm long). Both *C. arctata* and *C. capillaris* have relatively short pseudoculms and achenes without stalks.

As is characteristic of hybrids, the four plants of putative *C. castanea* × *C. debilis* have some characteristics of one parent, some of the other, some unique characteristics, and many characteristics that are expressed as intermediate between the putative parents (Table 1). In leaf pubescence the putative hybrids are like *C. castanea*, whereas in sheath pubescence they tend more towards intermediacy. The perigynia are narrower than in either putative parent, possibly because of the lack of distension by well developed achenes. In the length of the pistillate spike and width of tips of the pistillate bracts, the putative hybrids are closer to *C. debilis* (Table 1). Intermediacy is apparent to a greater or lesser extent in flower number in the pistillate spike, pistillate bract length and width, achene stalk length, length and width of the staminate scale, and width of the staminate scale near the tip (Table 1). Although the short stalks of the achenes, whether the latter are developed or not, are clearly intermediate, they could be viewed as a developmental anomaly. For this reason and because developed achenes where the stalk length is most easily assessed are scarce, the intermediate stalk length is of limited value in the recognition of the hybrid.

Both putative parents occurred within 15 m of the hybrid plants.

Table 1. Minimum, maximum, mean and standard deviation for 14 characters in *Carex arctata*, *C. castanea*, *C. debilis*, *C. × knieskernii* and putative *C. castanea × debilis*.

Character (units)	<i>C. debilis</i>				<i>C. castanea × debilis</i>			
	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD
1. Maximum leaf width (mm)	1.5	5.2	3.30	1.143	1.6	2.1	1.80	0.245
2. Length of longest hair on lower leaf (mm)	0.0	0.1	0.05	0.053	0.5	0.6	0.52	0.050
3. Total fertile culm height (cm)	21.0	60.0	36.61	11.470	22.5	34.2	27.65	4.858
4. Lowest peduncle length (cm)	4.5	13.2	7.52	2.691	5.2	9.2	6.92	1.723
5. Lowest pistillate spike length (mm)	18.0	59.0	32.40	12.038	23.0	35.0	29.50	5.196
6. Lowest pistillate spike, flower number (no.)	7.0	20.0	12.00	3.972	12.0	21.0	16.00	3.916
7. Third lowest pistillate bract length (mm)	2.1	3.2	2.74	0.370	2.5	3.0	2.80	0.216
8. Third lowest pistillate bract width (mm)	0.9	1.3	1.13	0.125	1.2	1.4	1.32	0.096
9. Third, width 0.5 mm from tip (mm)	0.5	0.9	0.65	0.127	0.5	0.8	0.65	0.129
10. Perigynium length (mm)	4.2	7.1	5.42	0.872	4.5	4.9	4.75	0.173
11. Perigynium, length of stipitate base (mm)	0.1	0.2	0.14	0.052	0.0	0.1	0.05	0.057
12. Achene, length of stipitate base (mm)	0.4	0.9	0.65	0.135	0.2	0.3	0.24	0.041
13. Third lowest staminate scale length (mm)	3.1	4.2	3.52	0.305	4.2	4.5	4.32	0.150
14. Third lowest staminate scale width (mm)	1.1	1.5	1.24	0.151	1.2	1.6	1.40	0.183
15. Third, width 0.5 mm from tip (mm)	0.7	1.2	0.86	0.165	0.6	0.8	0.70	0.115

Table 1. Continued.

Character (units)	<i>C. castanea</i>				<i>C. × knieskernii</i>				<i>C. arctata</i>			
	Min	Max.	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD
1. Maximum leaf width (mm)	5.2	7.5	6.08	0.721	4.0	7.2	4.22	0.320	4.5	9.5	6.59	1.652
2. Length of longest hair on lower leaf (mm)	0.5	0.7	0.56	0.084	0.2	0.4	0.37	0.050	0.0	0.0	0.0	0.0
3. Total fertile culm height (cm)	40.8	94.5	55.05	16.114	37.7	54.0	43.15	7.358	39.0	57.1	47.23	5.515
4. Lowest peduncle length (cm)	2.0	4.0	2.89	0.631	2.9	4.8	3.92	0.818	6.3	15.5	9.08	2.871
5. Lowest pistillate spike length (mm)	16.0	28.0	20.80	3.824	24.0	39.0	31.75	6.946	33.0	59.0	45.20	7.641
6. Lowest pistillate spike, flower number (no.)	17.0	38.0	25.20	6.460	18.0	29.0	25.00	4.830	15.0	44.0	27.20	7.969
7. Third lowest pistillate bract length (mm)	3.0	3.9	3.50	0.350	2.7	3.4	3.02	0.299	3.0	4.4	3.56	0.488
8. Third lowest pistillate bract width (mm)	1.2	1.7	1.50	0.169	1.4	1.6	1.50	0.082	1.2	1.8	1.55	0.158
9. Third, width 0.5 mm from tip (mm)	0.2	0.5	0.35	0.085	0.1	0.5	0.30	0.183	0.1	0.3	0.12	0.063
10. Perigynium length (mm)	4.4	5.3	4.78	0.282	3.6	4.8	4.32	0.550	3.1	4.4	3.85	0.450
11. Perigynium, length of stipitate base (mm)	0.1	0.2	0.13	0.048	0.1	0.3	0.22	0.096	0.2	0.4	0.35	0.070
12. Achene, length of stipitate base (mm)	0	0.1	0.09	0.032	0	0.1	0.07	0.050	0	0.1	0.02	0.042
13. Third lowest staminate scale length (mm)	3.8	5.4	4.83	0.525	4.1	4.4	4.25	0.129	3.5	4.5	4.15	0.303
14. Third lowest staminate scale width (mm)	1.2	2.0	1.52	0.248	1.6	1.6	1.6	0	1.2	1.7	1.5	0.141
15. Third, width 0.5 mm from tip (mm)	0.3	0.6	0.47	0.106	0.6	1	0.8	0.182	0.4	0.9	0.64	0.158

Thus the circumstantial evidence for the hybrid nature of the evidently intermediate plants was strong.

In addition to characters noted in the key, this new hybrid may be distinguished from *C. × knieskernii* by shorter fertile culms 22–34 cm high, and longer lower peduncles 5–9 cm long. *Carex × knieskernii* has fertile culms up to 54 cm tall, and lower peduncles 2.9–4.8 cm long (Table 1).

Over much of its northeastern range, *C. castanea* is a plant of alkaline soils (pH above 6.5), whereas *C. debilis* is a plant of acid substrates, usually sand or shallow soil over granitic rock. The waters of the Larder River running into Wendigo Lake have a relatively high pH (7.1 in July), but away from the shore substrates are characteristically acid, being either sand or shallow soil over bedrock. Along the shoreline, which is subject to seasonal fluctuation, many plant species occur that are characteristic of alkaline substrates, but they are evidently limited to the region below the level of the highest water. Examples include *Carex buxbaumii*, *Carex flava*, *Equisetum scirpoides*, *Platanthera psychodes*, and *Rhamnus alnifolia*. The *C. castanea × C. debilis* hybrids occurred with *Rubus pubescens* and the rare *Scirpus clintonii* in a transition from shoreline thicket dominated by *Alnus rugosa* and *Myrica gale* to mixed woods with *Abies balsamea*, *Picea mariana*, *Thuja occidentalis*, and *Betula papyrifera*. *Carex castanea* occurred in the shrub thickets. Above this level is a characteristic acid ground flora which included *C. debilis* as well as *Clintonia borealis*, *Cornus canadensis*, *Epigaea repens*, *Lycopodium* spp., and *Vaccinium myrtilloides*. Consequently a rather unusual situation existed where acid substrates were adjacent to alkaline substrates, thus allowing *C. castanea* and *C. debilis*, species otherwise edaphically isolated, to come into close contact.

The following key and description of the new hybrid will enable it to be differentiated from related taxa.

#### KEY TO *CAREX* SECT. *SYLVATICAE* IN ONTARIO

- 1a. Leaf sheaths and especially blades glabrous or scabrous, the longer hairs less than 0.1 mm . . . . . 2
- 1b. Leaf sheaths and blades conspicuously hairy, the hairs 0.2–0.7 mm long . . . . . 3
- 2a. Achenes with a stalk 0.4–1 mm long . . . . . *C. debilis*

- 2b. Achenes stalkless, or stalk less than 0.1 mm long .....  
 ..... *C. arctata*  
 3a. Achenes mostly well developed ..... *C. castanea*  
 3b. Achenes mostly more or less aborted ..... 4  
 4a. Leaves 1.5–2.5 mm wide ..... *C. castanea* × *C. debilis*  
 4b. Leaves 4–7.2 mm wide .....  
 ..... *C. × knieskernii* (*C. arctata* × *C. castanea*)

### ***Carex castanea* × *C. debilis***

Caespitose perennial. **Fertile culms** 22–34 cm tall, with reddish bladeless sheaths at the base, these becoming filamentous with age. **Leaves** 2–5 per fertile culm, mostly in the basal third, the blades 1–8 cm long, 1.5–2.5 mm wide, pubescent with hairs 0.1–0.6 mm long on both surfaces; sheaths 3–8 cm long, pubescent with hairs 0.1–0.4 mm long, the inner band brownish-translucent, sometimes with minute reddish dots upwardly; ligule of uppermost fertile culm leaf rounded or triangular, 2.5–4 mm long, 0.5–0.8 mm wide, brownish-hyaline usually with minute red dots and a pubescent margin. **Pseudoculms** 30–45 cm long including blades 1–40 cm long, 1.5–2.5 mm wide, with sheaths to 10 cm long, ligules 3–5 mm long, as in fertile culms. **Infructescence** 12–20 cm long; spikes 3–4, peduncled, the lower peduncles 5.2–10.1 cm long; **pistillate spikes** 2–3, 23–35 mm long, with 12–21 flowers; lowermost bract with blade 6–11 cm long, 1–1.3 mm wide, sheath 30–40 mm long, the upper bracts much reduced; **staminate spike** solitary, terminal, 20–27 mm long, ca. 20–30-flowered. Lower **pistillate scales** whitish-brown or pale brown centrally with whitish-hyaline margins, ovate, acute, 2.5–3 mm long, 1.2–1.4 mm wide, 0.5–0.8 mm wide 0.5 mm from tip, more or less pubescent on the margins. Lower **staminate scales** pale brown centrally with broad white hyaline margins, oblong, rounded at the tip, 4.2–4.5 mm long, 1.2–1.6 mm wide, 0.6–0.8 mm wide 0.5 mm from tip, pubescent on the margins. **Perigynia** ascending, sessile or with a stalk to 0.1 mm long, brown when mature, often with obscure reddish dots and flecks, especially basally, glabrous, 4.5–4.9 mm long, 1–1.4 mm wide, with two prominent lateral veins and 3–5 less pronounced veins, the body ovate tapering to an obscurely bidentate beak 0.9–1.3(1.5) mm long with teeth 0.1–0.2 mm long. **Achenes** rarely developing, pale brown with lighter brown edges, trigonous, obpyriform and slightly inflated above the stalk, the

body 1.3–1.5 mm long, 0.7–1 mm wide, the basal stalk 0.2–0.3 mm. **Styles** indurate in lower third, brittle and shrivelled above, straight above achene; stigmas 3. **Anthers** 3, 0.9–1.2 mm long, not fully developed, nor exerted. Pollen mostly not developed or malformed.

**MATERIAL EXAMINED: ONTARIO:** Timiskaming District: Bayly Twp.; wooded east shore of Lower Wendigo Lake, 47°52'00"N.L., 79°41'19"W.L., Map 31 M/13 983024, 11 August 1991, *V. R. Catling & P. M. Catling 91-224* (DAO, MICH).

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#### LITERATURE CITED

CAYOUILLE, J. AND CATLING, P. M. 1992. Hybridization in the genus *Carex*. *Botanical Review* 58: 351–438.

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